

FAMILY DISTRIBUTION AND FAUNAL AREAS.

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All of us have looked at the prettily colored maps of the faunal areas of the world or of parts of it, and have wondered at the windings of black lines up and down and across the map and have admired the genius that constructed the plan.

But I think that nearly all who have taken some interest in the geographical distribution of certain restricted groups have concluded that their particular group was of abnormal distribution; that it did not follow the maps.

These faunal maps have been made mostly for the larger animals, and doubtless for them fairly accurate. It is my purpose to show in this paper that any one map of faunal areas will not explain the distribution of all groups. In other words, the faunal areas vary with the family, or even genus. If, for example, we consider the distribution of the neuropterous family Panorpidae (scorpion-flies) in our country the first point we note is the great distinction between the Eastern States and the Western Region. The largest genus, *Panorpa*, is common all through the Eastern States, and absent from the Western States, unless a Mexican species may occur in Southern California. The genus *Bittacus* is also common in the East, but not very common in the West, and there represented by peculiar forms. The genus *Boreus* occurs across the northern part of the United States, as common in the Northwest as in the East. The genus *Panorpodes* has but two species—one in North Carolina, one in Oregon. There is nothing in this distribution to show the relation of the Californian fauna to that of Europe, for *Panorpa* is common in Europe, and their *Bittacus* are more like our Eastern species than like the Western ones.

If we look at the species of *Panorpa* we can readily see faunal areas in the East. So if one were to map the distribution of our Panorpidae he must show the distinctness of the eastern and western regions and that the eastern region is more like that of Europe.

If, for example, we consider the distribution of another neuropterous family, the snake-flies (Raphidiidae), we come to very different conclusions. This family has many species in Europe; in America they are common in the Western States, absolutely absent from the Eastern States. Neither is it a family of boreal distribution, for none occur far north and one occurs in Baja California. As with the Panorpidae, one must emphasize the difference between Eastern and Western faunas, yet the Western is the one with relations to Europe.

If, now, we look at the distribution of the orb-weaving spiders (Epeiridæ) in our country, we note at once that there is little difference east and west, but much greater difference north and south. Many of the northern forms are European species and range from Maine to Vancouver. A peculiarity of these northern species is that they extend farther south in California than in the Eastern States. Similarly the genera like *Acrosoma*, that extend up from the South into all parts of the southern United States, range farther northward in the Eastern States than on the Pacific Slope. With these southern spiders we can trace the extension of southern faunas up into valleys that open to the South. So if we map the distribution of our Epeiridæ we must pay little attention to eastern and western areas, but to northern and southern; to the extension of northern forms southward along mountains, and the extension of southern forms northward along valleys and coastal plains. There is nothing in this family to show that the western forms are more European than the eastern ones.

The small neuropterous family Mantispidæ is of southern origin, and extends in our country northward along valleys and plains, in the East into Massachusetts, and in the central plain into Canada.

If we consider the distribution of the Phalangida in the United States, we must lay stress on the difference between eastern and western forms, and that the western is more European. The families Nemastomatidæ and Troglidæ, fairly common in the West, are almost absent in the East, and then only in the Northeastern States. In the Phalangida we notice also this northern fauna extending across the country, farther southward in the West than in the East; but in this case there are few species that extend across the country, but the genera have such an extension. Although there are various elements in the West that show relation to Europe, yet the largest genus in the family *Liobunum* is more abundant in Europe and the Eastern States than in the West. In the Phalangida we must also call attention to the forms, like *Cynorta*, that have spread northward from Mexico and the West Indies. This genus has different species in the East than in West, and in the East ranges farther northward. So in the Phalangida we get a combination of the distribution seen in the other groups considered; the relation of the Californian to the European, the genera that spread up from the South, and the genera that extend across the North. But all through runs the difference between the East and the West.

If we consider the neuropterous family Hemerobiidæ we reach other conclusions. The genus *Hemerobius* is a northern one and common in Europe and the northern United States. But the species from the Western States are not more like the European than the eastern forms; indeed, the species most abundant in the East is a common European species. The genus *Micromus* in our fauna contains two different elements; one of the northern species occurring in mountainous regions is the same, or closely related to certain European forms; the other element represents species derived from the *Micromus* species that occur in all tropical countries; these are much more widely spread and much more abundant than the northern forms, which are rare and local. Our most striking hemerobiid is *Polystachotes*, fully as abundant in the Northwest as anywhere, yet there is no such form in Europe; they have *Osmylus* fairly common, while we have none. Their *Drepanopteryx* is most closely related to our *Lomamyia*, which is of southern distribution; their *Dilar* occurs with us only in the Southeastern States. The genus *Symphorobius* is of similar distribution. This exhibits another point, the similarity between the Southern part of the United States and Southern Europe. Taken as a whole the hemerobiid fauna of Europe is more like that of the Eastern than the Western States.

If we examine the distribution of the caddice flies of the family Limnephilidæ, we see that our entire limnephilid fauna is closely similar to that of Europe. There are no southern forms of these to spread up over the south or Atlantic coast. Yet in the United States we can readily detect differences between eastern and western faunas. While there are many that are of northern distribution, the eastern fauna as a whole has more resemblance to the central and southern European forms, while the western and Pacific Northwest is more related to the north of Europe and to Russia and Siberia.

None of these families that I have mentioned are dependent upon vegetation for distribution; most of the species are predaceous; but the habits of each group are quite different from the others.

The southern extension of northern species varies with the family; in *Micromus* and some northern Epeiras, they extend across the country, usually in the high mountains. With others, as *Phalangium cinereum*, they extend southward into western North Carolina and into western New Mexico. The northern extension of southern species is also variable; in some cases, as in *Mantispa* and *Lathrodictes*, they go up into New England and Canada; with most species, however, the range is less extensive.

It is not necessary to go on with other families; it is evident that as far as insects and arachnids of this country are concerned, one cannot make a map that will express the faunal areas of all families.

It is evident, I think, that the distribution of a group does not depend entirely upon the contour of a country, its plants, geological history, or distribution of other groups, but is partly due to the origin of the group and to its methods of dispersal. Other causes may affect the distribution of a group; such as whether its immature stages are passed under ground or above ground, or whether the winter is passed in egg-stage or as a partly grown insect; whether it feeds in adult condition or not, etc.

These same facts will, I believe, be found to influence the distribution of a group throughout the world.

In the family Myrmeleonidæ (ant-lion flies) there are a few genera like *Myrmeleon* and *Acanthaclisis* that occur in all countries, and *Glenurus* in all tropical regions. A few genera, like *Dendroleon*, are common to Europe and North America, but our most characteristic genus, *Brachynemurus*, does not occur in Europe, but in Central and South America.

The most characteristic African and Indian genus, *Palpares*, extends into Southern Europe, but not in Japan, while several other European genera occur in Africa. But the Australian forms, while showing affinity to the European fauna by having *Formicaleo* and *Gymnocnemis*, do not have *Palpares* and *Tomatares* or any allied forms. Nor do these latter genera extend into the Malay region, or Insulinde. None of the Australian forms show any particular relation to the South American fauna. However, if we take the family Nempopteridæ, we find that the Australian forms show relation to India, Persia, South Africa, and Chile, as well as less closely to North Africa and to South Europe.

The flying power of an insect has little to do with its distribution; the dragon-flies of the Eastern and Western United States are more different than some groups of lesser flying capacity.

The spread of an insect is not accidental, nor due to a scarcity of food, but to the desire of the fertilized female to deposit her eggs away from the place of her birth. The hindrances to distribution vary with each species.

Considering these facts, I think we should not attempt to make maps of the distribution of groups much larger than families, nor draw generalizations from one group expecting they will apply equally as accurately to other groups.